HELPFUL HINTS ON Modern Locomotive Brakes

By T. F. LYONS

HELPFUL HINTS

ON

MODERN LOCOMOTIVE BRAKES

Being a short treatise on E-T and L-T types of brakes

Setting forth the defects, tests for defects, and remedies for same

---

BY

T. F. LYONS

546 EAST 109TH STREET

CLEVELAND, OHIO

PREFACE

In offering this little book to those who have to do with the operation and care of the locomotive brake, it is not the intention to give an extended treatise on these two types of brakes, but rather offer such information as may be made use of in refreshing our memory on things that we already knew, but may have forgotten, and at the same time point out the different defects of the apparatus, with tests for locating the defects, and possible remedies for same. While much more might be said in regard to making repairs while on the road, yet the writer has well in mind the fact that locomotives are not as well supplied with tools and repair parts as they might be. While again, in these busy days, about all that is asked of the engineer is to be able to make a quick repair, if possible, and not cause delay to train movement; keeping well in mind that Safety First should be the motto of every man in train service.

That benefit might be derived from what is here written, it is suggested that, where possible, the different tests and remedies here given be tried out before it becomes necessary to use them, as it will be found that an ounce of *experience* is worth a pound of book knowledge.

INDEX

INDEX—Continued

WESTINGHOUSE No. 6 E-T EQUIPMENT

Q.—On what is this brake designed to operate?

A.—On engine and tender.

Q.—What are some of the many advantages of the E-T equipment over older types of locomotive brakes?

A.—May be used on engines in any class of service. Brake cylinder pressure not affected by piston travel or brake cylinder leakage. Locomotive brake may be applied or released independent of the train brake. Brake on second engine of a doubleheader may be applied or released independent of the brakes on the leading engine or train.

Q.—Name the parts of the equipment and explain in a general way their duties.

A.—1. The air pump, to compress the air used on the locomotive and cars.

2. The duplex governor, to control the pump when the desired pressure is obtained in the main reservoir.

3. The main reservoir, in which to store a large volume of air for the prompt charging and recharging of the brakes and to collect the moisture and dirt in the air.

4. The main reservoir cut-out cock, which, when closed, cuts off the communication between the main reservoir and brake system.

5. The automatic brake valve, to operate the locomotive and train brakes.

6. The equalizing reservoir, to furnish the proper volume of air above the equalizing piston.

7. The independent brake valve, to operate the locomotive brake independent of the train brake.

8. The feed valve, to regulate the brake pipe pressure, when the automatic brake valve is in running or holding position.

9. The reducing valve, to regulate the pressure in the independent brake valve and signal line.

10. The distributing valve, its reservoir and safety valve, to admit air to and from the brake cylinders on the locomotive, in applying and releasing the brakes, and to control the brake cylinder pressure within the prescribed limits.

11. Two duplex air gauges, one to indicate the main reservoir and equalizing reservoir pressures, the other to indicate the brake pipe and locomotive brake cylinder pressures.

12. The dead engine feature, by which air may be supplied to the main reservoir of an engine, the pump of which is inoperative. The above, with the necessary brake cylinders, air strainers, cut-out cocks, hose couplings and piping, go to make up the No. 6 E-T equipment.

Q.—Commencing at the air pump, name the different pipes and their connections.

A.—Discharge pipe: To connect the air pump to the first main reservoir.

Connecting pipe: To connect the two main reservoirs.

Main reservoir pipe: To connect the second main reservoir to the maximum head of the pump governor, distributing valve, feed valve, reducing valve and automatic brake valve. This pipe also furnishes air to the connections of all other air-operated appliances on the locomotive.

Feed valve pipe: To connect the feed valve to the automatic brake valve.

Excess pressure pipe: To connect the feed valve pipe to the chamber above the diaphragm of the excess pressure head of the governor.

Excess pressure operating pipe: To connect the automatic brake valve to the chamber below the diaphragm of the excess pressure head of the governor.

Reducing valve pipe: To connect the reducing valve to the air signal line and independent brake valve.

Brake pipe: To connect the automatic brake valve with the distributing valve and train brakes.

Brake cylinder pipe: To connect the distributing valve to the different brake cylinders on the locomotive.

Application cylinder pipe: To connect the application cylinder of the distribut-

ing valve to the independent and automatic brake valves.

Distributing valve release pipe: To connect the application cylinder exhaust port with the automatic brake valve, through the independent brake valve, when the latter is in running position.

Pump Governor Tests

Q.—What is the first thing to be observed when testing the governor?

A.—That all pipes are open and free from dirt, all connections tight, and that the vent port and drain port are open.

Q.—In what position should the automatic brake valve be placed when adjusting the excess pressure head; the maximum pressure head?

A.—Running position for the excess pressure head; lap position for the maximum pressure head.

Q.—If with the automatic brake valve in running position the brake pipe and main reservoir pressures do not stand twenty pounds apart, where would you look for the trouble?

A.—Would first learn if the maximum pressure head was properly adjusted, and if it was, would look for the trouble in the adjustment of the regulating spring in the excess pressure head.

Q.—What should be done?

A.—The regulating spring in the ex-

cess pressure head should be properly adjusted.

Q.—How should the adjustment of the regulating spring in either pressure head be made?

A.—By removing the cap nut and screwing the regulating nut up or down as may be required.

Q.—What would be the effect if one or both pin valves leaked?

A.—Would cause a delay in the opening of the steam valve after the pin valve had seated; and if the air leaked by faster than it could escape through the relief port, pressure would accumulate in the chamber above the governor piston, forcing it downward, so as to wholly or partly close the steam valve.

Q.—How can you tell if the pin valve leaks?

A.—If the pin valve leaks, it will be indicated by a constant blow of air at the relief port.

Q.—What would be the effect of the vent port stopping up?

A.—The duty of the vent port is to allow the air to escape from the chamber above the governor piston when the pin valve closes so that the pump will start promptly. If the port be stopped up, the air will have to leak past the packing ring of the governor piston, and out the drip port; how quickly it will do this depends on the fit of the packing ring; if the fit

is at all close, the steam valve may not open until some time after the pin valve closes.

Q.—What does steam blowing at the drain pipe indicate?

A.—A worn steam valve stem or bush.

Q.—What would be the effect of a frozen or stopped up drain pipe?

A.—If the drain pipe is frozen or stopped up, and the stem of the steam valve leaking, steam will feed up into the chamber under the governor piston and prevent the piston being forced downward to close the steam valve; the pump will therefore continue to work until the main reservoir pressure is about equal to boiler pressure.

Broken Pipes

Q.—What would be the effect if the upper pipe to the excess pressure head broke off?

A.—The pump would stop when the main reservoir pressure was in excess of 40 pounds.

Q.—If this pipe breaks, what should be done?

A.—Plug the pipe toward the feed valve pipe and put a blind gasket in the pipe leading to the chamber below the diaphragm of the excess pressure head.

Q.—What should be done if the pipe leading to the chamber below the diaphragm breaks?

A.—Plug the pipe toward the brake valve and proceed.

Q.—With one or both of the pipes leading to the excess pressure head broken, what would control the pump?

A.—The maximum pressure head.

Q.—What should be done if the pipe leading to the maximum pressure head breaks?

A.—Plug the pipe toward the main reservoir and proceed.

Q.—With this pipe broken what would control the pump?

A.—The excess pressure head would control the pump in release, running or holding position; but would have no control in lap, service or emergency position, or when the main reservoir cut-out cock was closed; therefore, the action of the pump would have to be governed by throttling the steam valve.

Air Pumps

Q.—How many different size pumps, in general use on railroads, are made by the Westinghouse Air Brake Co.?

A.—Three. They are known as the 9½-inch, 11-inch, and cross-compound pumps.

Q.—What is meant by the figures 9½ and 11?

A.—These figures indicate the diameter of the steam and air cylinders of these pumps.

Q.—What is the length of stroke?

A.—The 9½-inch pump has a 10-inch stroke, while the 11-inch has 12-inch stroke.

Q.—Is there any difference in the operation of the 9½-inch and the 11-inch pumps?

A.—No; the arrangement of the valve gear and air valves are the same in both pumps; the only difference in these two pumps being in their capacity.

Q.—What is meant by a cross-compound pump?

A.—This means that both the steam and air are compounded; that is, the steam is used the second time before it is exhausted, while the air is compressed the second time before it is forced into the main reservoir.

Q.—Is the valve gear of the cross-compound pump similar to that of the 9½-inch and 11-inch pumps?

A.—Yes.

Q.—Is a slide valve used to distribute the steam the same as in the 9½- and 11-inch pumps?

A.—No; a piston type of valve is used, consisting of three piston heads, which control the flow of steam to and from both cylinders.

Q.—How many cylinders has the cross-compound pump?

A.—Four: two steam cylinders and two air cylinders.

Q.—Name the different cylinders.

A.—High and low pressure steam cylinders; high and low pressure air cylinders.

Q.—What is the diameter of the different cylinders?

A.—The high pressure steam cylinder is 8½ inches; low pressure steam cylinder, 14½ inches; low pressure air cylinder, 14½ inches; high pressure air cylinder, 9 inches.

Q.—What is the length of stroke?

A.—Twelve inches.

Q.—How are the cylinders located?

A.—The low pressure air cylinder is under the high pressure steam cylinder, and the high pressure air cylinder is under the low pressure steam cylinder.

Q.—Is the low pressure steam piston in any way connected with the valve gear of the pump?

A.—No; this is simply a floating piston and depends entirely on the exhaust steam from the high pressure steam cylinder for its steam supply.

Q.—How many air valves used in the 9½- and 11-inch pumps?

A.—Four: two receiving and two discharge valves.

Q.—How many air valves used in the cross-compound pump?

A.—Ten: four receiving, four intermediate discharge and two final discharge valves.

Q.—Are the air valves in the different pumps the same size?

A.—No; the valves used in the 9½-inch pump are all the same size and are 1½ inches in diameter; those used in the 11-inch pump are all one size and are 2 inches in diameter; while in the cross-compound pump the receiving and final discharge valves are one size, and of the size used in the 11-inch pump, and the intermediate discharge valves are all one size, and of the size used in the 9½-inch pump.

Q.—What should be the lift of the air valves?

A.—The air valves in all Westinghouse pumps should have the same lift; namely, $\frac{3}{32}$ of an inch.

Q.—If the air valves have too much lift, what will be the result?

A.—Will cause the pump to pound.

Q.—What are the duties of the air valves?

A.—The receiving valves admit the air to the pump from and prevent its return to the atmosphere; the discharge valves allow the air to pass from the pump to the main reservoir and prevent its return; while the intermediate discharge valves, in the cross-compound pump, permit the air to pass from the low pressure air cylinder to the high pressure air cylinder, and prevent its return to the low pressure air cylinder.

Q.—What kind of oil should be used in the steam and air cylinders and on the swab?

A.—Valve oil.

Q.—Why not use engine oil?

A.—Engine oil might be used were it not that its burning point is below the working temperature of the cylinders of the pump.

Caring for the Pump

Q.—How should an air pump be started?

A.—The pump should be started slow, with the drain cocks open, to allow the water of condensation to escape; and as no provision is made in the steam end to cushion the piston at the end of its stroke, it should be allowed to work slowly until a pressure of thirty or forty pounds is accumulated in the main reservoir; the piston having to work against this pressure, will be cushioned at the end of each stroke. After the pump is warm, the drain cocks should be closed and the throttle opened sufficient to run the pump at the proper speed.

Q.—At what speed should the pump be run to obtain the best results?

A.—At 100 to 120 single strokes per minute.

Q.—How should the pump be lubricated?

A.—After the water has worked out of

the pump the lubricator should be started and allowed to feed freely until eight or ten drops have passed to the pump; the feed should then be reduced to an amount sufficient for proper lubrication.

Q.—Does the low pressure air cylinder of a cross-compound pump require as much oil as the high pressure cylinder?

A.—No.

Q.—Why?

A.—The low pressure air cylinder does not require as much oil, as it is constantly receiving cool air from the atmosphere, and compresses it to a pressure of about forty pounds only; therefore, but little heat is created, which means but little oil is required; whereas the air in the high pressure air cylinder has to be compressed to a pressure equal to that carried in the main reservoir, and as the air this cylinder receives is compressed air from the low pressure air cylinder, the temperature will be much higher, therefore will require lubricating oftener.

Defects of the Pump

Q.—What are some of the common causes for the air pump stopping?

A.—Lack of lubrication, bent or broken reversing rod, loose or worn reversing plate, nuts on air end of piston coming off, defective pump governor, and in addition, with the cross-compound pump, final discharge valve broken or stuck

open, or packing rings in the main valve pistons breaking and catching in the steam ports.

Q.—What causes the piston to make an uneven stroke?

A.—This may be caused by broken or stuck open air valves, or valves not having the proper lift. Where the piston short-strokes, it is generally caused by over-lubrication of the steam end.

Q.—What are some of the common causes for the pump running hot?

A.—The overheating of a pump may be due to one of the following causes: running at high speed; working against high pressure; packing rings in air piston badly worn; air cylinder worn; defective air valves; air passages in pump or air discharge pipe partially stopped up; leaky piston rod packing.

Q.—What will cause the air pump to run slow?

A.—This may be caused by leaky packing rings in the air piston; final discharge valves leaking, or air passages partially stopped up. A defective pump governor may also cause the pump to run slow.

Q.—What will cause the pump to run very fast and heat, and not compress any air?

A.—This may be caused by the strainer becoming clogged with ice or dirt, preventing air entering the cylinder.

Locating Defects and Remedy for Same

Q.—If, when steam is first turned on, the piston makes a stroke up and stops, where would you look for the trouble?

A.—The shoulder on the reversing rod may be worn; the opening in the reversing plate too large to engage the shoulder on the reversing rod; loose reversing plate studs preventing the piston traveling far enough to reverse the pump, or the main valve stuck in its position at the right.

Q.—If a piston makes a stroke up and a stroke down and stops, where is the trouble?

A.—This may be caused by a loose reversing plate, or the button on the lower end of the reversing rod worn or broken off, or the nuts off the piston rod in the air end of the pump, or the main valve stuck in its position at the left.

Q.—If a receiving valve breaks or sticks open, how may it be located?

A.—The air will flow back to the atmosphere as the piston moves toward the defective valve and may be detected by holding the hand over the strainer.

Q.—If a receiving valve in the cross-compound pump breaks, what may be done?

A.—Remove the broken valve, blocking the opening made by its removal, and as

there are two upper and two lower receiving valves the pump will now take air through the other valve.

Q.—If an intermediate discharge valve breaks or sticks open, how may it be located?

A.—No air will be taken into the pump, as the piston moves from defective valve and may be located by holding the hand over the strainer.

Q.—If an intermediate discharge valve breaks, what may be done?

A.—Remove the broken valve, blocking the opening made by its removal, and as there are two upper and two lower intermediate discharge valves the air will now pass from the low pressure cylinder to the high pressure cylinder through the other valve.

Q.—If a final discharge valve breaks, what effect will it have on the pump?

A.—Will cause the pump to stop when the main reservoir pressure is in excess of forty pounds.

Q.—How would you test for a defective final discharge valve?

A.—To test for this defect, bleed the main reservoir pressure below forty pounds, and if the pump starts it indicates a defective discharge valve.

Q.—If a final discharge valve breaks, what may be done?

A.—As the receiving valves and final discharge valves are the same size, the

broken final discharge valve may be replaced by one of the receiving valves blocking the opening made by the removal of the receiving valve.

Q.—What will cause the piston to make a quick up stroke?

A.—This may be caused by a broken or stuck-open upper receiving or lower discharge valve.

Q.—How will this cause the piston to make a quick up stroke?

A.—In the case of an upper receiving valve, air would be drawn into the cylinder on the down stroke, but would blow back to the atmosphere on the up stroke; therefore the piston, having no work to do, will move up quickly. If the lower discharge valve were at fault, main reservoir air would flow back under the piston, causing a quick up stroke, as the main reservoir pressure would assist the steam pressure in the movement of the piston; the down stroke, however, would be slow, as the piston would have to work against main reservoir pressure from the beginning of the stroke. No air would be taken into the pump on the up stroke.

Q.—What will cause the piston to make a quick down stroke?

A.—Lower receiving or upper discharge valve broken or stuck open.

Q.—Where piston rod packing is blowing bad, what may be done to stop it?

A.—Piston rod packing blowing gen-

erally indicates lack of proper lubrication, and by cleaning and oiling the swab the trouble may be overcome. However, there are times when leakage by the packing is so great that the oil is blown off the swab as fast as it is applied, therefore is of no value in lubricating the parts. Where this condition exists, a little hard grease wrapped up in an old flag and tied around the piston rod will insure its being lubricated.

Q.—How often should the air end of the pump be oiled?

A.—No fixed rule can be given, as so much depends on the condition of the pump, as well as the amount of work required; but in any case it should be used sparingly.

Q.—Should oil be introduced through the strainer?

A.—No; as oiling in this manner has a tendency to gum up the air passage and air valves.

Q.—If the pump stops, how can you tell if the pump governor is responsible for the trouble?

A.—By opening the drain cock in the steam passage between the governor and the pump; if steam flows freely, the trouble is in the pump; if not, it is in the governor.

Q.—How may a pump often be started when it stops?

A.—By closing the steam throttle for

a few seconds, then opening it quickly; if this does not start it, try tapping the main valve chamber. This will usually overcome the trouble where the pump stops on account of lack of lubrication.

Q.—What will cause a pump to short-stroke or dance?

A.—Too much oil in the steam end; bent reversing rod; or low steam pressure, as when the governor has almost shut off the steam.

Air Cylinder Lubricator

Q.—What is the purpose of the air cylinder lubricator?

A.—To furnish a practical and an effective means of securing proper lubrication for the air cylinder of the pump.

Q.—Of what does this cylinder lubricator consist?

A.—Of three parts: sight-feed fitting, emergency throttle valve, and the check valve connection.

Q.—What are the duties of the several parts?

A.—The sight-feed attachment is to regulate the amount of oil to the pump. The emergency throttle valve is used to throttle the pressure from the lubricator to the sight-feed valve, and to cut off the oil completely when not in use. The check valve connection is connected directly to the air cylinder of the pump, and consists of a ball check seating up-

ward, which prevents the compressed air from entering the oil pipe.

Q.—To what is the air cylinder lubricator connected?

A.—To the oil reservoir of the main lubricator, at one end, and the air cylinder of the pump at the other.

Q.—Explain the operation of the lubricator.

A.—First, the emergency throttle should be opened about one-half turn and then closed; then the sight-feed valve opened a sufficient length of time to permit from five to eight drops of oil to pass to the pump, then closed. This lubricator must not be treated as a lubricator for continuous feeding, but must be employed rather as a valve for use only when it becomes necessary to feed a few drops of oil to the pump.

Automatic Brake Valve

Q.—Name the different positions of the H-6 brake valve.

A.—Release, running, holding, lap, service, and emergency.

Q.—With what type of locomotive brake is this valve used?

A.—With the E-T equipment, of which it is a part.

Q.—To what is the automatic brake valve attached?

A.—To the brake valve pipe bracket.

Q.—Are there any pipe connections direct to the brake valve?

A.—No; all pipe connections are made direct to the pipe bracket; this allows for the changing of the brake valve without the breaking of the pipe joints.

Q.—What is the purpose of release position?

A.—To provide a large and direct opening from the main reservoir to the brake pipe, for the free flow of air, when charging and recharging the brakes.

Q.—What pressure will be had in the brake pipe if the brake valve be left in release position?

A.—Main reservoir pressure.

Q.—Can the locomotive brake be released by the automatic brake valve in release position?

A.—No; as the port in the automatic brake valve to which the distributing valve release pipe is attached is blanked in this position of the valve.

Q.—What is the purpose of running position, and when should it be used?

A.—This is the proper position for the brake valve when the brakes are charged and not in use, also when it is desired to release the locomotive brake with this valve. This position of the valve may be used in releasing the brakes on short trains of, say, six or eight cars. In this position the brake pipe pressure is maintained at a predetermined amount by the

feed valve, as all air that now enters the brake pipe and equalizing reservoir must pass through the feed valve.

Q.—What is the purpose of holding position?

A.—To hold the locomotive brake applied while recharging the brakes. The charging of the brake pipe and equalizing reservoir is the same in holding as in running position; in other words, the only difference between the two positions is that the locomotive brake is released in running position, while it is held applied in holding position.

Q.—What is the purpose of lap position?

A.—To hold both the locomotive and train brakes applied after an automatic application. In this position all ports in the brake valve are closed.

Q.—What is the purpose of service position?

A.—This position of the brake valve enables the engineer to make a gradual reduction of brake pipe pressure, thus causing a service application of the brakes.

Q.—What is the purpose of emergency position?

A.—In this position of the brake valve, the brake pipe is connected directly with the atmosphere through the large ports in the valve, causing a sudden reduction of brake pipe pressure, this in turn caus-

ing the distributing valve on the engine and all operating triple valves on cars in the train to move to emergency position, thus insuring a quick and full application of the brake.

Q.—How should the brake valve be handled when making an emergency application of the brake?

A.—The valve should be placed in full emergency position and left there until the train stops, even though the danger may have disappeared.

Brake Valve Defects and Remedy for Same

Q.—If the handle of the brake valve does not operate easily, what may be the trouble and how remedied?

A.—If the brake valve does not operate freely, it is probably due to a dry rotary valve or rotary valve key gasket. This trouble may be remedied by first closing the cut-out cock under the brake valve, then closing the main reservoir cut-out cock, and when the air pressure has escaped, remove the oil plug in the valve body and fill the oil hole with oil, then move the valve from release to emergency position and back a few times; this gives the oil a chance to work under the rotary; then refill the oil hole and replace the plug; next, remove the cap nut from the rotary valve key, fill the oil hole, and push down on the key; this allows the

oil to get down on the key gasket; again fill the oil hole and replace the cap nut.

Q.—What will cause the handle to move hard over notches of the different positions of the valve?

A.—This is caused by the handle bolt or latch becoming dry; a few drops of oil on the parts will overcome the trouble.

Q.—What will cause a constant blow at the brake pipe exhaust port, and what may be done to overcome it?

A.—This indicates that the brake pipe exhaust valve is being held off its seat, due no doubt to dirt; tapping the side of the valve will sometimes stop the blow; if not, close the brake pipe cut-out cock and make a heavy service reduction; next, place the handle in release position; this will cause a strong blow at the exhaust port, which will invariably remove the trouble.

Q.—If the pipe connecting the brake valve with the equalizing reservoir breaks, can the brake be operated with the automatic brake valve?

A.—Yes.

Q.—How can this be done?

A.—By placing a blind gasket in the pipe connection at the brake valve and plugging the brake pipe exhaust port. To apply the brake, move the handle carefully toward emergency position, making the reduction gradually through the direct exhaust port; when the desired re-

duction is made, the valve should be moved gradually back to lap position.

Q.—What would be the effect if the valve were moved to lap quickly?

A.—Would cause the release of the brakes on the head end of the train.

Q.—What will cause air to blow at the brake pipe exhaust port when the valve is moved to lap position?

A.—This is caused by a leak from the equalizing reservoir or its connections, which reduces the pressure in chamber D above the equalizing piston, allowing brake pipe pressure under the piston to force it up, unseating the brake pipe exhaust valve, permitting the air to flow to the atmosphere.

Q.—What is the time required to reduce the equalizing reservoir pressure twenty pounds?

A.—From six to seven seconds, with a 70-pound pressure, and five to six seconds with a 110-pound pressure.

Q.—If the time required is greater than that here given, what does it indicate?

A.—This indicates leakage of air into chamber D from either the main reservoir port, feed valve port, or brake pipe port.

Q.—If, when the automatic brake valve is moved to service position, and air exhausts at the back of the brake valve, and the brake pipe exhaust port does not

open, neither does the black hand on the gauge drop back, what might be the trouble?

A.—This indicates leakage of air into chamber D faster than it can be exhausted through the preliminary exhaust port, therefore the pressure above the equalizing piston will not be reduced, consequently the piston will not rise to unseat the brake pipe exhaust valve. Leakage into this chamber may sometimes be overcome by tightening the bolts in the brake valve.

Q.—Can the brakes be applied in service where this condition exists?

A.—Yes; by moving the handle carefully toward emergency position, making a gradual reduction of brake pipe pressure, service braking may be done the same as where an equalizing reservoir pipe is broken off.

Q.—What defect in the brake valve will cause the brake pipe and main reservoir pressure to equalize when the handle is in running position?

A.—This may be caused by leakage past the rotary valve or the body gasket.

Q.—How may it be known which part is at fault?

A.—To determine which part is at fault, close the cut-out cock under the brake valve and move the handle to service position, exhausting all air from chamber D and the brake pipe; then re-

turn the handle to lap position. Leakage of air past the rotary valve is generally into the brake pipe port, which allows the air to come in under the equalizing piston, forcing it upward, unseating the brake pipe exhaust valve, allowing this air to escape to the atmosphere at the brake pipe exhaust port. Leakage past the body gasket allows air to enter chamber D, above the equalizing piston, holding it in its lower position, keeping the brake pipe exhaust valve closed, thereby preventing the escape of this air to the atmosphere. Since the capacity of the equalizing reservoir and chamber D is small, such a leak will cause the black hand to quickly move up to the position of the red hand.

Q.—What effect will the absence of the brake pipe exhaust fitting have in service braking?

A.—This may cause an undesired emergency application of the brake, especially with a short train.

Q.—If, while making a service application of the brake, the brake pipe exhaust valve closes suddenly, and the black hand drops quickly, what may be the cause?

A.—The sudden closing of the brake pipe exhaust valve means that for some reason there has been a sudden drop of brake pipe pressure; and this may be caused by a burst hose, train parting, or the triple valves throughout the train go-

ing to emergency position. If the black hand goes back to the pin, it indicates a burst hose or train parted; whereas, if air again begins to blow at the exhaust port, it indicates a defective triple valve some place in the train, or a defective distributing valve on the engine.

Feed Valve

Q.—What is the duty of the feed valve?

A.—To control and maintain a constant pressure in the brake pipe when the brake valve is in running or holding position.

Q.—Name the pipe connections to the feed valve.

A.—Main reservoir pipe, which brings main reservoir air to the feed valve; feed valve pipe, which conducts main reservoir air, at a reduced pressure, to the feed valve port in the automatic brake valve.

Q.—With the automatic brake valve in running or holding position, and the regulating spring properly adjusted, what defect in the feed valve will cause the brake pipe pressure to equalize with that in the main reservoir?

A.—This may be caused by a defective feed valve case gasket, permitting main reservoir air to leak into the feed valve pipe, or leakage past the supply valve, or the regulating valve held from its seat, or

the supply valve piston too tight a fit in its cylinder.

Q.—With the engine alone, the brake pipe pressure will equalize with that in the main reservoir, while when coupled to a train the pressure will remain at that for which the feed valve is adjusted; where is the trouble?

A.—This is caused by light leakage of main reservoir air into the brake pipe, and may be coming past the rotary valve, body gasket or feed valve, and with the lone engine is sufficient to raise the brake pipe pressure to that in the main reservoir; while when coupled to a train, the brake pipe leakage of which is greater than that of the feed valve, this will not be noticed.

Q.—How should the feed valve be tested?

A.—With the brakes released, and charged to the adjustment of the feed valve, create a brake pipe leak of from seven to ten pounds and note the black hand on the brake pipe gauge. The fluctuation of this hand will indicate the opening and closing of the feed valve, which should not permit a variation of over two pounds in the brake pipe pressure; if it does, it indicates a dirty condition of the valve, and should be cleaned.

Q.—If the brake pipe charges too slowly when nearing the maximum pressure, where is the trouble?

A.—This may be caused by a loose-fitting supply valve piston, or the port past the regulating valve partly stopped up.

Q.—If the main reservoir pipe connection to the feed valve breaks, what should be done?

A.—This will cause a loss of main reservoir air, and pipe must be plugged toward the main reservoir.

Q.—With this pipe broken, how can the brake pipe be charged, and where should the brake valve handle be carried?

A.—As no air now comes to the feed valve to charge the train in running or holding position, the handle must be carried in full release position.

Q.—What must be done if the pipe between the feed valve and the automatic brake valve breaks?

A.—Slack off on the regulating nut of the feed valve until all tension is removed from the regulating spring and plug the pipe toward the brake valve—this to stop the flow of air. The brake valve will have to be handled the same as with a broken main reservoir connection.

Q.—If the brake valve be carried in release position, will there not be a tendency for the locomotive brake to creep on?

A.—Yes.

Q.—How can this be avoided?

A.—This trouble may be overcome by

disconnecting the release pipe at the distributing valve.

Q.—With either or both of these pipes broken, and the brake valve handle carried in release position, what will control the main reservoir and brake pipe pressure?

A.—The maximum pressure head of the pump governor, which should be adjusted to the brake pipe pressure carried.

Q.—If the feed valve becomes defective so that it will not control brake pipe pressure, what may be done?

A.—As the reducing valve used for the straight air and the feed valve are practically the same, they may be changed one for the other, the reducing valve taking the place of the feed valve.

Independent Brake Valve

Q.—To what is the independent brake valve attached?

A.—To a pipe bracket.

Q.—Are there any pipe connections direct to this valve?

A.—No; all pipe connections are made direct to the pipe bracket as with the automatic valve.

Q.—Name the pipes and their connections to the independent brake valve.

A.—Reducing valve pipe, which leads to the reducing valve. Application cylinder pipe, which leads to and is the middle pipe on the left side of the distributing

valve; also connects to the automatic brake valve. Distributing valve release pipe, which leads to and is the lower pipe on the left side of the distributing valve; this pipe also has a connection between the independent and automatic brake valves.

Q.—Name the position of the brake valve.

A.—Release, running, lap, slow-application position, quick-application position.

Q.—What is the purpose of release position?

A.—To release the locomotive brake when the automatic brake valve is in other than running position.

Q.—What is the purpose of running position?

A.—Running position is the proper position for the brake valve when not in use, and to release the locomotive brake when the automatic brake valve is in running position.

Q.—What is the purpose of lap position?

A.—To hold the locomotive brake applied after an independent application.

Q.—What is the purpose of slow-application position?

A.—This position may be used when it is desired to make a light or gradual application of the brake, as in stretching or bunching the slack of a train.

Q.—What is the purpose of quick-application position?

A.—To apply the locomotive brake quickly, as in short switching.

Q.—What is the purpose of the return spring?

A.—To automatically return the valve to running position from full release position; also from quick- to slow-application position.

Q.—Why is this done?

A.—The automatic return from release to running position is to prevent leaving the valve in release position, as in this position the automatic brake would not remain applied on the locomotive. The action of the spring in the return of the valve from quick to slow application is simply to make more marked the latter position; that is, to act as a stop for this position.

Q.—What pressure is usually developed with this brake?

A.—About 45 pounds.

Q.—What controls this pressure?

A.—The reducing valve, which regulates the pressure in the reducing valve pipe and independent brake valve.

Q.—If the pipe between the reducing valve and independent brake valve breaks, what must be done?

A.—This pipe breaking will cause a loss of main reservoir air, which may be

stopped by backing off on the regulating nut in the reducing valve.

Q.—If this pipe breaks, can the locomotive brake be applied?

A.—The independent brake and air signal will be lost; but by plugging the exhaust port of the independent brake valve the automatic brake may be applied and released in the usual manner with the automatic brake valve.

Q.—Where the reducing valve pipe is broken, why is it necessary to plug the independent brake valve exhaust port that an automatic application of the brake may be made on the engine?

A.—Where this pipe is broken, there will be no air pressure on top of the rotary in the independent brake valve to hold it to its seat; therefore, when an automatic application of the brake is made, pressure forming under the rotary valve by the air coming from the application cylinder and chamber will lift the rotary valve from its seat and allow the air in the application chamber and cylinder to escape to the atmosphere through the independent brake valve exhaust port, thus causing the release of the locomotive brake.

Dead Engine Feature

Q.—What is the dead engine device?

A.—The dead engine device is nothing more or less than a pipe connection be-

tween the main reservoir pipe and the brake pipe. In this pipe is found a combined strainer and check valve with a choke fitting and a cut-out cock, which when open forms a connection between the main reservoir pipe and brake pipe.

Q.—What is the purpose of this device?

A.—To provide a means of charging the main reservoir of an engine whose pump is inoperative.

Q.—What is the object in charging the main reservoir of an engine with a disabled pump?

A.—As the air used in applying the locomotive brake comes from the main reservoir, for the brake to be operated on this engine it is necessary that its main reservoir be charged.

Q.—With a 70-pound brake pipe pressure, what pressure will be had in the main reservoir when using this device?

A.—About 50 pounds.

Q.—When the dead engine feature is being used, in what position should the automatic and independent brake valves be carried?

A.—Running position.

Q.—What should be the position of the brake pipe cut-out cock below the brake valve?

A.—It should be closed.

Distributing Valve

Q.—What is the duty of the distributing valve?

A.—To admit air from the main reservoir to the locomotive brake cylinders when applying the brake, to exhaust the air from the brake cylinders when releasing the brake, to automatically maintain the brake cylinder pressure against leakage, and to develop the proper brake cylinder pressure regardless of piston travel.

Q.—To what is the distributing valve attached?

A.—To the distributing valve reservoir.

Q.—How many chambers has the distributing valve reservoir?

A.—Two-pressure chamber and application chamber.

Q.—Name the different pipe connections to the distributing valve reservoir.

A.—Main reservoir supply pipe, application cylinder pipe, distributing valve release pipe, brake cylinder pipe, and brake pipe.

Q.—To what do these different pipes connect?

A.—The main reservoir supply pipe, which is the upper pipe on the left, connects the distributing valve with the main reservoir pipe.

The application cylinder pipe, which is the middle pipe on the left, connects the application cylinder of the distributing

valve with the automatic and independent brake valve.

The distributing valve release pipe, which is the lower pipe on the left, connects the application cylinder exhaust port in the distributing valve with the independent brake valve, and through it, when in running position, to the automatic brake valve.

The brake cylinder pipe, which is the upper pipe on the right, connects the distributing valve with the different brake cylinders on the locomotive.

The brake pipe branch pipe, which is the lower pipe on the right, connects the distributing valve with the brake pipe.

Q.—Explain briefly the operation of the distributing valve when making an automatic service application of the brake.

A.—When a gradual reduction of brake pipe pressure is made, it will be felt in the chamber in front of the equalizing piston, causing a difference of pressure on the two sides of the piston, which will cause the piston to move to application position. The first movement of the piston closes the feed groove, also moves the graduating valve, uncovering the service port in the equalizing slide valve; this movement of the piston also causes the shoulder on the end of its stem to engage the equalizing slide valve, and the continued movement of the piston moves the

valve to service position, in which the service port in the slide valve connects with a port in the seat which leads to the application chamber and cylinder. As the equalizing slide valve chamber is at all times connected to the pressure chamber, air can now flow from this chamber to both the application chamber and cylinder. Pressure chamber air will continue to flow to the application chamber and cylinder until its pressure becomes slightly less than that in the brake pipe, when the piston and graduating valve will move to the left until the shoulder on the piston stem strikes the slide valve; this movement of the graduating valve closes the service port, thus closing the communication between the pressure chamber and application chamber and cylinder, also closing the port which leads to the safety valve.

Q.—Upon what does the amount of pressure in the application cylinder and chamber depend, when making an automatic service application of the brake?

A.—On the amount of brake pipe reduction; and as the relative volume of the pressure chamber and application cylinder and chamber is practically the same as that of an auxiliary reservoir and brake cylinder, it will be understood that one pound from the pressure chamber will make two and one-half pounds in the application chamber and cylinder; in

other words, with the pressure chamber charged to 70 pounds and no pressure in the application cylinder or chamber, if they were connected and allowed to equalize they would do so at about 50 pounds; that is, 20 pounds from the pressure chamber would make 50 pounds in the application chamber and cylinder.

Q.—How is the application piston affected by the air pressure in the application cylinder?

A.—Pressure forming in this cylinder will force the piston to application position. In moving to this position it will carry with it the exhaust valve, closing the exhaust port, at the same time moving the application valve, opening the supply port, allowing main reservoir air to flow to the different brake cylinders on the locomotive, until the pressure in these cylinders becomes slightly greater than that in the application cylinder, when the piston will move back, carrying the application valve with it, just far enough to close the supply port.

Q.—With the application valve in lap position, if there be brake cylinder leakage, will the locomotive brake leak off?

A.—No; any drop in brake cylinder pressure will be felt in the chamber on the brake cylinder side of the application piston, causing a difference in pressure on the two sides of the piston, thus allowing the pressure in the application cylin-

der to move the application piston and valve, again opening the supply port, allowing main reservoir air to flow to the brake cylinders until the pressure is again slightly greater than that in the application cylinder, when the application piston and valve will move back to lap position. Thus in this way air will be supplied to the brake cylinders of the locomotive, holding the brake applied regardless of brake cylinder leakage.

Q.—What effect will the piston travel have on pressure developed in the brake cylinders?

A.—None; as the pressure in the brake cylinders is dependent entirely on the pressure in the application cylinder, which is not affected by the piston travel.

Q.—Explain the movement of the parts in the distributing valve when the automatic brake valve is moved to release position, after an automatic application of the brake.

A.—In release position, air from the main reservoir flows direct to the brake pipe, causing a rise of pressure in the chamber in front of the equalizing piston; this increase of pressure above that on the pressure chamber side of the piston will cause the piston to move to release position, carrying with it the graduating and equalizing slide valves. In this position the application cylinder exhaust port is connected to the distribut-

ing valve release pipe and on through the independent brake valve to the automatic brake valve, where the port to which this pipe leads is blanked by the automatic rotary valve, which prevents air from leaving the application cylinder and chamber, thus holding the locomotive brake applied while the train brakes are being released.

Q.—Explain the movements of the parts in the distributing valve when the automatic brake valve is moved to running position after having first been moved to release or holding position, following a brake application.

A.—In this position the port to which the distributing valve release pipe is connected at the automatic brake valve is open to the exhaust, thus allowing the air in the application cylinder and chamber to escape to the atmosphere. The reduction of application cylinder pressure causes the application piston to move to release position, carrying with it the application valve and exhaust valve, opening the exhaust port, allowing the brake cylinder air to escape to the atmosphere, releasing the brake.

Q.—Explain what takes place in the distributing valve when an automatic emergency application of the brake is made.

A.—Any sudden reduction of brake pipe pressure will be felt on the brake

pipe side of the equalizing piston, and will cause it and the equalizing slide valve to move to the extreme travel, compressing the graduating spring. In this position, pressure chamber air can flow into the application cylinder only; this will cause a quick rise of pressure in the application cylinder, forcing the application piston and valve to full application position, opening the supply port, allowing main reservoir air to flow to the locomotive brake cylinders until the pressure in the brake cylinder is slightly greater than that in the application cylinder, when the application piston and valve will move back to lap position, as in a service application.

Q.—At what pressure will the pressure chamber and application cylinder equalize when using a 70-pound brake pipe pressure?

A.—At about 65 pounds; as in emergency position the application chamber is cut off. However, with the automatic brake valve in emergency position, there is a small port in the rotary valve (called the blow-down timing port) open to the application pipe and cylinder which allows main reservoir air to flow to the application cylinder, raising its pressure to the adjustment of the safety valve.

Safety Valve

Q.—At what pressure is the safety valve adjusted?

A.—At 68 pounds, except where an engine is being transported over the road light, when it is generally adjusted to 35 pounds.

Q.—How would you proceed to adjust the safety valve?

A.—With the pressure pumped up, move the automatic brake valve to emergency position until a brake cylinder pressure of 68 pounds is developed, then back to lap position; next turn the regulating nut on the safety valve up or down, as may be required.

Q.—To what is the safety valve connected?

A.—The safety valve is connected to the application cylinder, except in service lap position, when it is cut off by the graduating valve.

Q.—How does the safety valve prevent too high a pressure in the brake cylinder?

A.—The pressure developed in the brake cylinders is governed by the pressure in the application cylinder, which is within control of the safety valve.

Quick-Action Cap

Q.—What is the purpose of the quick-action cap, and where is it located?

A.—Its purpose is to assist the brake valve in venting the brake pipe air when an emergency application of the brake is made, and it is located on the brake pipe side of the distributing valve.

Q.—Explain the operation of the quick-action cap.

A.—When a sudden brake pipe reduction is made, it will cause the equalizing piston to move quickly to its extreme travel, the knob on the piston striking the graduating stem, causing it to compress the graduating spring, moving the emergency valve, opening the emergency port; this allows brake pipe air to flow past the check valve, and on to the brake cylinders. When the brake pipe pressure becomes slightly less than the brake cylinder pressure, the check valve will seat; thus preventing the brake cylinder air flowing back to the brake pipe. When the brake is released, the equalizing piston moving back to release position, the graduating spring then forces the emergency valve back to closed position.

Q.—Where the quick-action cap is used, is there any difference in the method of operating the brake?

A.—No.

Broken Pipes

Q.—If the main reservoir supply pipe to the distributing valve breaks, what should be done?

A.—As this will cause a loss of main reservoir air, the pipe should be plugged.

Q.—If the supply pipe breaks and is plugged, can the locomotive brake be ap-

plied in a service application? In emergency application?

A.—The locomotive brake cannot be applied in service application, but if the distributing valve is equipped with a quick-action cap, and an emergency application is made, the air coming from the brake pipe, through the quick-action cap will apply the brake.

Q.—If, with the engine alone and the supply pipe broken, can the locomotive brake be applied; if so, how?

A.—Yes; with the engine alone the brake can be applied, providing the distributing valve is equipped with a quick-action cap. To apply the brake, move the automatic brake valve handle to emergency position, and then return it to holding position until the brake pipe is recharged to about 45 pounds, when the handle should be moved to lap position. The movement of the brake valve to emergency position causes the equalizing piston in the distributing valve to move to emergency position, and in so doing moves the emergency valve in the quick-action cap to open position, thereby creating an opening from the brake pipe to the brake cylinders; then by admitting more air to the brake pipe it is free to flow to the brake cylinders, applying the brake. The end of the supply pipe toward the distributing valve must be plugged.

Q.—If the brake pipe be recharged above 50 pounds, what will be the effect?

A.—The brake will release down to a pressure of about 15 pounds.

Q.—If the distributing valve is not equipped with a quick-action cap, can the locomotive brake be operated with the supply pipe broken?

A.—Yes; the locomotive brake can be operated by first plugging the supply pipe connection to the distributing valve, also the distributing exhaust port; then remove the application piston; to do this, it is necessary to first remove the application valve cover and take out the application valve and its stem, then replace the cover; next remove the application cylinder cover and take out the application piston, then replace the cover. Desiring to apply the brake, move the independent brake valve to quick-application position, air coming from the reducing valve will flow through the application cylinder pipe to the application chamber and cylinder, and as the application piston is now removed, the air will be free to flow to the brake cylinder port and to the brake cylinders, applying the brake.

Q.—If the locomotive brake be applied in the manner just described, how may it be released?

A.—By placing the independent brake valve in release position.

Q.—If the application cylinder pipe breaks, what effect will it have on the locomotive brake?

A.—The brake cannot be applied with either the automatic or the independent brake valve.

Q.—If the application cylinder pipe breaks and is plugged, can the locomotive brake be operated?

A.—Yes; the brake can be applied and released with the automatic brake valve in the usual manner.

Q.—If this pipe breaks, can the locomotive brake be applied with the independent brake valve?

A.—This depends on where the pipe is broken. If the break is between the distributing valve and the tee, where the pipe branches, one part leading to the independent brake valve, the other part to the automatic brake valve, or between the tee and the independent brake valve, the use of the independent brake valve is lost; but if the break is between the tee and the automatic brake valve, if the pipe be plugged, the brake may be applied and released in the usual manner with the independent brake valve, only the blow-down timing feature is lost.

Q.—If the distributing valve release pipe breaks, what will be the effect?

A.—The holding feature of the brake will be lost; that is, the locomotive brake will release when the automatic brake

valve is moved to release or holding position, the same as with the old G-6 equipment.

Q.—If the release pipe breaks, should it be plugged?

A.—No; as, when this pipe is plugged, any leakage of air into the application cylinder or chamber will cause the locomotive brakes to creep on, and the creeping on of the brakes is so often responsible for the loosing of tires that anything which tends to bring about this condition should be avoided.

Q.—If this pipe breaks and is plugged, can the locomotive brake be applied and released?

A.—Yes; the brake can be applied with either the automatic or the independent brake valve; but it can be released only by placing the independent brake valve in release position.

Q.—If the release pipe is broken and not plugged, can the independent brake be applied?

A.—Yes, by placing the brake valve in quick-application position the brake will apply, but there will be a waste of air through the broken pipe, and the brake will release when the valve is returned to lap position.

Q.—If the brake cylinder pipe breaks, can the locomotive brake be applied?

A.—This depends on where the pipe breaks; if between the cut-out cock and

any one of the brake cylinders, close the cut-out cock to that cylinder, and the other cylinders may be used. But if the pipe breaks at the distributing valve, the locomotive brake will be lost.

Q.—If the brake cylinder pipe breaks and is not plugged, as where the brake is inoperative, what must be done?

A.—The cut-out cock in the main reservoir supply pipe to the distributing valve must be closed.

Q.—If the supply pipe cut-out cock is not closed, what will result?

A.—There will be a great loss of main reservoir air through the broken pipe each time the train brake is applied.

Q.—Is there any other way of preventing the loss of main reservoir air through this broken pipe than by closing the cut-out cock in the supply pipe?

A.—Yes; if the independent brake valve be held in release position, while the train brake is being applied, the application piston in the distributing valve will remain in release position; therefore, there will be no waste of air.

Q.—If the brake pipe connection to the distributing valve breaks, what should be done?

A.—Plug the end leading from the brake pipe; the locomotive brake must now be released by placing the independent brake valve in release position.

Q.—If this pipe breaks and is plugged,

can the locomotive brake be applied with the automatic brake valve?

A.—A service application of the brake cannot be made, as now there is no connection between the brake pipe and the distributing valve; however, if the brake valve handle be placed in emergency position, the blow-down timing port will be open to the application cylinder, thus causing an application of the brake.

Q.—If the brake be applied in the manner just described, can it be released with the automatic brake valve?

A.—No; it must be released by placing the independent brake valve in release position.

Q.—If the brake pipe connection to the distributing valve breaks and is plugged, can the independent brake be operated?

A.—Yes; the brake may be applied in the usual manner, but will have to be released by placing the independent brake valve in release position.

Distributing Valve Defects

Q.—If there is a blow at the distributing valve exhause port when the brake is released, where would you look for the trouble?

A.—This would indicate a leaky application valve, or where the distributing valve is equipped with a quick-action cylinder cap, a leak past the emergency valve will also cause a blow at this port.

Q.—How may it be determined which valve is at fault?

A.—Reduce the brake pipe pressure to zero, then release the brake with the independent brake valve; if the blow continues, the defect will be found in the application valve; if the blow stops, the emergency valve will be at fault.

Q.—If there be a continuous blow at the distributing valve exhaust port when the brake is applied, where would you look for the trouble?

A.—This would indicate a leaky exhaust valve.

Q.—If the locomotive brake released with the automatic brake valve in lap position, where would you look for the trouble?

A.—Would look for a leak in the application cylinder pipe or in the application cylinder cover gasket.

Q.—If the brake remained applied in lap position, but released in release or holding position, where would you look for the trouble?

A.—Would look for a leak in the distributing valve release pipe.

Q.—If, after making a light brake application, the brake cylinder pressure continued to increase to about 45 pounds, where would you look for the trouble?

A.—This would indicate leakage of air into the application cylinder and chamber, coming from some source where a

pressure of 45 pounds is maintained, which means from the independent brake valve; would therefore look for leakage past the rotary valve or lower body gasket of the independent brake valve.

Q.—If, after making a 10-pound reduction of brake pipe pressure, the brake cylinder pressure increased to about 50 pounds, where would you look for the trouble? (This when using a 70-pound brake pipe pressure.)

A.—This would indicate leakage of pressure chamber air past the equalizing slide valve in the distributing valve.

Q.—If, after making a light application, the brake cylinder pressure increased to the adjustment of the safety valve, where would you look for the trouble?

A.—This trouble may be caused by leakage past the rotary valve or either of the two lower body gaskets in the automatic brake valve, into the application cylinder pipe.

Q.—If the distributing valve release pipe and application cylinder pipe were crossed, what would be the effect?

A.—A brake application made by the automatic brake valve cannot be released by the independent brake valve.

Q.—If the safety valve leaks, what will be the effect?

A.—This may prevent the brake applying, and in an independent application if the brake does apply, it will release

when the brake valve is returned to lap position.

Locomotive Brake Creeps On

Q.—If the locomotive brake creeps on with the automatic and independent brake valves in running position, where would you look for the trouble?

A.—This is caused by a variation of brake pipe pressure due either to a non-sensitive feed valve or an overcharged brake pipe, which causes the equalizing piston and slide valve in the distributing valve to move to application position, making an automatic application of the brake.

Q.—If the locomotive brake creeps on, how should it be released?

A.—By moving the automatic brake valve handle to release position and returning it immediately to running position.

Q.—Why not make the release with the independent brake valve?

A.—Where the brake is released with the independent brake valve, the equalizing piston and its slide valve are not moved to release position, therefore the brake would immediately reapply.

NEW YORK L-T EQUIPMENT

Q.—On what is this brake designed to operate?

A.—On engine and tender.

Q.—What are some of the advantages of the L-T equipment over older types of locomotive brakes?

A.—May be used on engines in any class of service. Brake cylinder pressure not affected by piston travel or leakage; locomotive brake may be applied or released independent of the train brake; brakes on the second engine of a double-header may be applied or released independent of the brakes on the leading engine or train.

Q.—Name the different parts of the equipment, and explain in a general way their duties.

A.—1. The air pump, to compress the air used on the locomotive and cars.

2. The duplex governor, to control the pump when the desired pressure is obtained in the main reservoir.

3. The main reservoir, in which to store a large volume of air for the prompt charging and recharging of the brakes, and to collect the moisture and dirt in the air.

4. The main reservoir cut-out cock, which, when closed, cuts off the communication between the main reservoir and the brake system.

5. The automatic brake valve, to operate the locomotive and train brake.

6. The equalizing reservoir, to furnish the proper volume of air above the equalizing piston.

7. The special release valve, to release the locomotive brakes after an automatic application, independent of the train brakes.

8. The double-throw check valve, to form a dividing line in the brake cylinder pipe between the control valve and independent brake valve.

9. The independent brake valve, to operate the locomotive brake independent of the train brake.

10. The feed valve, to regulate the brake pipe pressure, when the automatic brake valve is in running or holding position.

11. The reducing valve, to regulate the pressure in the independent brake valve and signal line.

12. The control valve, its reservoir and safety valve, to admit air to and from the brake cylinders on the locomotive, when applying and releasing the brakes, and to control the pressure within the prescribed limits, in all automatic applications.

13. Two duplex air gauges, one to indicate main reservoir and equalizing reservoir pressures, the other to indicate

brake pipe pressure and locomotive brake cylinder pressure.

14. The dead engine feature, by which air may be supplied to the main reservoir of an engine, the pump of which is inoperative.

The above, with the necessary brake cylinders, air strainers, cut-out cocks, hose couplings and piping, go to make up the L-T equipment.

Q.—Commencing at the air pump, name the different pipes and their connections.

A.—Discharge pipe, to connect the pump to the first main reservoir.

Connecting pipe, to connect the two main reservoirs.

Main reservoir pipe, to connect the second main reservoir with the maximum pressure head of the pump governor, control valve, feed valve, reducing valve, and automatic brake valve. This pipe also furnishes air to the connections of all other air-operated appliances on the locomotive.

Feed valve pipe, to connect the feed valve with the automatic brake valve.

Excess pressure pipe, to connect the feed valve pipe to the chamber above the diaphragm in the excess pressure head of the pump governor.

Excess pressure operating pipe, to connect the automatic brake valve to the

chamber below the diaphragm in the excess pressure head of the pump governor.

Maximum pressure head pipe, to connect the maximum pressure head of the governor to the main reservoir pipe.

Reducing valve pipe, to connect the reducing valve with the air signal line and independent brake valve.

Brake pipe, to connect the automatic brake valve with the control valve and train brakes.

Brake cylinder pipe, to connect the control valve and independent brake valve with the different brake cylinders on the locomotive.

Control reservoir pipe, to connect the control reservoir of the control valve with the automatic brake valve and special release valve.

Automatic control valve release pipe, to connect the control reservoir exhause port with the automatic brake valve.

Continuous feed pipe, to connect the reducing valve pipe to the auxiliary reservoir in the automatic control valve.

Duplex Pump Governor

Q.—Explain the operation of the pump governor.

A.—As the governor used with the L-T equipment is the same in principle of operation as that described in the E-T equipment, no further description will be given here.

Duplex Air Pumps

Q.—How many different size pumps are made by the New York Air Brake Company?

A.—Four; they are known as Numbers 1, 2, 5 and 6.

Q.—What are the dimensions of these pumps?

A.—The dimensions are as follows:

Pump No.	Diam. of steam cyl.	Diam. of L. P. air cyl.	Diam. of H. P. air cyl.	Stroke
1	5 in.	7 in.	5 in.	9 in.
2	7 in.	10 in.	7 in.	9 in.
5	8 in.	12 in.	8 in.	12 in.
6	7 in.	11 in.	7 in.	10 in.

Q.—Name the different cylinders of the pump.

A.—The two lower are known as stem cylinders; the two upper as the low pressure and high pressure air cylinders.

Steam End of Pump

Q.—Of what does the valve gear of these different pumps consist?

A.—Of two ordinary D slide valves in the older make of pumps, while a later type has piston valves; these valves are actuated by tappet rods, which extend into the hollow piston rods, and are moved by the tappet plates, which are fastened to the steam piston heads.

Q.—How is the admission and exhaust of steam controlled?

A.—The valve under one cylinder controls the admission of steam to and from the opposite cylinder, so that when one piston is moving the other is at rest.

Q.—How should the pump be started?

A.—Before turning on steam, the drain cocks should be open and left so until the pump is warm and the water of condensation worked out. No provision is made in the steam end to cushion the pistons at the end of the stroke; for when working against pressure the air in the air cylinders acts as a cushion. When the pump is first started, there is no air in the main reservoir, and consequently there is nothing to prevent the pistons from striking the cylinder heads if the pump be started quickly. Therefore, the pump should be started slowly until a pressure of 30 or 40 pounds is accumulated in the main reservoir to cushion the pistons, when the throttle may be opened wide enough to run the pump at the required speed. The drain cocks should then be closed and the lubricator started and allowed to feed freely until eight or ten drops have passed to the pump; the feed should then be reduced to an amount sufficient for proper lubrication.

Air End of Pump

Q.—How many air valves in each of the No. 1 and No. 2 pumps?

A.—Six, namely: one upper and one

lower receiving valve, one upper and one lower intermediate discharge valve, and one upper and one lower final discharge valve.

Q.—How many air valves in each of the No. 5 and No. 6 pumps?

A.—Eight, namely: one upper and one lower receiving valve for the low pressure air cylinder, one upper and one lower intermediate discharge valve, one upper and one lower receiving valve for the high pressure cylinder, and one upper and one lower final discharge valve.

Q.—What should be the lift of the different air valves?

A.—In the No. 1 and No. 2 pumps all valves should have $\frac{1}{16}$ inch lift; in the No. 5 and No. 6 all valves should have $\frac{3}{16}$ inch lift.

Q.—Explain the operation of the air end of the pump.

A.—As the piston in the low pressure cylinder moves up, a partial vacuum is formed below it, and air from the atmosphere enters past the lower receiving valve, filling this end of the cylinder with air at atmospheric pressure. In the meantime, the air above the piston, being compressed, will hold the upper receiving valve to its seat, and lifts the upper intermediate discharge valve from its seat, allowing the air to pass from the low to the high pressure cylinder. The high-pressure piston now moving up causes a

partial vacuum to be formed below it, and air from the atmosphere flows through the lower receiving valve of the high pressure cylinder, filling this end of the cylinder with air at about atmospheric pressure. The air above the piston being compressed, holds the upper intermediate valve to its seat, and lifts the upper final discharge valve, allowing the air to pass to the main reservoir. The action is the same on the down stroke, only the opposite valves are used. It may be seen from this that the air valves are nothing more or less than a set of check valves, which permit the air to pass in one direction, but prevent its return.

Defects of the Pump

Q.—If a receiving valve to the low pressure air cylinder breaks or sticks open, what effect will it have on the pump, and how may it be located?

A.—No air will be compressed by the low pressure cylinder, as the piston moves toward the defective valve, and may be located by noting the movement of the low pressure piston, as the movement will be much quicker toward the defective valve than the opposite stroke. Air will blow back to the atmosphere as the piston moves toward the defective valve, and may be detected by holding the hand over the strainer.

Q.—If an intermediate discharge valve

breaks or sticks open, what effect will it have on the pump, and how may it be located?

A.—If an intermediate discharge valve breaks or sticks open, no air will be compressed by that end of the pump where is located the defective valve, as the air will flow back and forth from the high to the low pressure cylinders; no air will be taken in from the atmosphere through either of the strainers, as the pistons move from the defective valve.

Q.—If a receiving valve to the high pressure air cylinder breaks or sticks open, what effect will it have on the pump, and how may it be located?

A.—No air will be compressed by that end of the pump where is located the defective valve, as the air from both cylinders will be free to return to the atmosphere through the broken valve. Both pistons will make a quicker stroke when moving in the direction of the defective valve. Air will blow back to the strainer of the high pressure cylinder, as each piston moves toward the defective valve.

Q.—If the final discharge valve breaks, what effect will it have on the pump?

A.—If a final discharge valve breaks, main reservoir air will be free to return to the high-pressure cylinder as the high pressure piston moves from the defective valve; therefore, no air will be taken in

through the receiving valve of the high pressure air cylinder at the end where is located the defective valve. The low pressure piston will make a slow stroke toward the defective valve and a normal stroke from it; while the high pressure piston will make a slow stroke toward the defective valve and a quick stroke from it, being assisted in the latter movement by the main reservoir air acting on the piston. Defective air valves may generally be located by noting the temperature of the valve chamber in which they are located.

Q.—What may be done if the receiving valve to the low pressure cylinder intermediate or final discharge valve breaks?

A.—As all valves are of the same size and have the same lift, the broken valve may be replaced by one of the receiving valves of the high pressure cylinder. Then, by blocking the opening made by the removal of this receiving valve, the pump will be practically restored to its maximum efficiency.

Q.—Can this be done with the No. 1 and No. 2 pumps?

A.—No; as the No. 1 and No. 2 pumps have no receiving valves in the high pressure cylinder which takes air direct from the atmosphere.

Q.—What will cause a pump to pound?

A.—The pump loose on its bracket, bracket loose on the boiler, nuts loose on

the air ends of the pistons, air valves having too much lift, water in the steam cylinders, or running the pump too fast before a sufficient pressure is accumulated in the main reservoir to cushion the pistons at the end of the stroke.

Q.—What will cause the pump to run hot?

A.—Running the pump too fast; working against high pressure; air piston packing rings leaking; air cylinders worn; air passages in pump or discharge pipe partially stopped up; air valves leaking; air valves stuck shut; or lack of lubrication.

Q.—If, when steam is first turned on, the steam piston at the right moves up and the pump stops, where would you look for the trouble?

A.—This would indicate a loose or worn tappet plate, tappet rod broken, or the button on the end of the rod worn, in the cylinder at the right, or the nuts off the low-pressure air piston rod.

Q.—If both pistons make a stroke up and the pump stops, what may be the cause?

A.—Loose or worn tappet plate on the piston at the left, or this tappet rod broken, or the button on the end of the rod worn, or the nuts off the high pressure air piston rod.

Q.—If both pistons make a stroke up and the piston at the right a stroke down

and the pump stops, what may be the trouble?

A.—This would indicate a worn tappet plate or the shoulder on the tappet rod in the cylinder at the right being worn so that the plate will pass over the tappet rod.

Q.—If both pistons make a stroke up and a stroke down and the pump stops, what may be the cause?

A.—This would indicate a worn tappet plate or shoulder on the tappet rod in the cylinder at the left.

Q.—If the pump stops, how may it sometimes be started?

A.—First, open the drain cock to learn if the steam is passing the governor; if it is, jar the steam head lightly; failing to start, close the throttle for a short time, then open it quickly; this will invariably start the pump where the cause of stopping was due to lack of lubrication.

Q.—How should the air end of the pump be oiled, and what grade of oil should be used?

A.—Oil should be used sparingly in the low pressure cylinder, but more is required in the high pressure cylinder, owing to higher temperature. A good quality of valve oil should be used.

Q.—How will the steam end of the pump be affected by the use of too much oil?

A.—This may cause the pump to short-stroke or "dance," especially where the piston type of valves is used.

Type "L" Automatic Brake Valve

Q.—What type of brake valve is used with the L-T equipment?

A.—The automatic brake valve known as the type L valve; it is of the rotary valve type, and is the same valve, port for port, as that used with the E-T equipment, and the same results should be obtained in the different positions as with the H-6 brake valve; therefore, no further description need be given here.

Double Pressure Feed Valve

Q.—What type of feed valve is used with the L-T equipment?

A.—The same type of valve is used as with the E-T equipment; therefore requires no further description here.

Independent Brake Valve

Q.—What type of valve is used as an independent brake valve with this equipment?

A.—This valve is of the slide valve type.

Q.—What is the duty of the independent brake valve?

A.—By its use the locomotive brake

may be applied and released independent of the train brake.

Q.—Name the different positions of this valve.

A.—Release, lap, service, and emergency positions; and in the latter type of valve a new position has been added, known as locomotive release position.

Q.—What is the purpose of release position?

A.—This is the position in which the handle should be carried when not in use. In this position the brake cylinder pipe, on the straight air side of the double check valve, is connected with the exhaust through a cavity in the slide valve.

Q.—What is the purpose of service position?

A.—In this position a small opening is made in the application port through which air can pass to the locomotive brake cylinders, applying the brake gradually.

Q.—What is the purpose of emergency position?

A.—In this position a full opening of the application port is had, allowing the air to flow rapidly from the reducing valve pipe to the locomotive brake cylinders, thus securing a quick application of the brake.

Q.—What is the purpose of locomotive release position?

A.—When the handle is moved to this position, any air in the control reservoir

of the control valve is free to escape to the atmosphere, thus securing an independent release, following an automatic application, of the locomotive brake.

Q.—What brake cylinder pressure is developed by this brake?

A.—About 45 pounds.

Q.—How is this and signal line pressure regulated?

A.—By the reducing valve, which is practically the same in its operation as the feed valve already described.

Automatic Control Valve

Q.—What is the duty of the control valve?

A.—To admit air from the main reservoir to the locomotive brake cylinders, when applying the brake; to exhaust the air from the brake cylinders, when releasing the brake; to automatically maintain the brake cylinder pressure against leakage, and to develop the proper brake cylinder pressure regardless of piston travel, in all automatic applications of the brake.

Q.—To what is the control valve attached?

A.—To a double chamber reservoir.

Q.—Name these chambers.

A.—Auxiliary reservoir and control reservoir.

Q.—Name the different pipe connections to the control reservoir.

A.—The upper pipe at the left, when facing the control valve, is the brake pipe connection; the lower pipe at the left, the brake cylinder pipe; the upper pipe at the right, the release pipe; the middle pipe at the right, the main reservoir supply pipe; the lower pipe at the right, the control reservoir pipe; the pipe connected to and in the middle of the reservoir, the continuous feed pipe.

Q.—To what do these different pipes connect?

A.—The brake pipe branch pipe, which is the upper pipe on the left, connects the control valve with the brake pipe.

The brake cylinder pipe, which is the lower pipe on the left, connects the control valve with the different brake cylinders on the locomotive.

The control release pipe, which is the upper pipe on the right, connects the control cylinder, through the slide valve, to the automatic brake valve.

The main reservoir supply pipe, which is the middle pipe on the right, connects the control valve with the main reservoir pipe.

The control reservoir pipe, which is the lower pipe on the right, connects the control reservoir with the automatic brake valve and the special release valve.

The continuous feed pipe, which is connected at the left side of the double

chamber reservoir, connects the auxiliary reservoir with the reducing valve pipe.

Q.—Explain the operation of the control valve when making an automatic service application of the brake.

A.—When a gradual reduction of brake pipe pressure is made, it will be felt in the chamber above the triple piston, causing a difference in pressure on the two sides of the piston, which will cause it to move upward to application position. The first movement of the piston closes the feed groove, also moves the graduating valve, uncovering the service port in the slide valve; and the continued movement of the piston moves the slide valve to service position, in which the service port in the slide valve connects with the port leading to the control reservoir. As the slide valve chamber and auxiliary reservoir are connected at all times, air can now flow from the auxiliary reservoir to the control cylinder and reservoir.

Q.—How long will the air continue to flow from the auxiliary reservoir to the control cylinder and reservoir?

A.—Until the pressure on the auxiliary reservoir side of the piston becomes slightly less than that on the brake pipe side of the piston, when the piston and graduating valve will move down until the shoulder on the piston strikes the slide valve; this movement of the graduating valve closes the service port, thus

closing the communication between the auxiliary reservoir and control cylinder and reservoir, also closing the port which leads to the safety valve.

Q.—Upon what does the amount of pressure in the control cylinder and reservoir depend when making an automatic service application of the brake?

A.—On the amount of brake pipe reduction; and as the relative volume of the auxiliary reservoir and control reservoir is as 2½ is to 1 it will be understood that one pound from the auxiliary reservoir will make 2½ pounds in the control cylinder and reservoir. In other words, with the auxiliary reservoir charged to 70 pounds, and no pressure in the control cylinder or reservoir, if they were connected the pressure would equalize at 50 pounds; that is, 20 pounds from the auxiliary reservoir will make 50 pounds in the control cylinder and reservoir.

Q.—How is the application piston in the control valve affected by the air pressure in the control cylinder?

A.—Pressure in this cylinder will force the piston downward or to application position. The piston in moving will carry with it the exhaust valve, closing the exhaust port, and at the same time unseat the application valve, thus allowing main reservoir air to flow to the brake cylinders on the locomotive.

Q.—How long will the air continue to flow to the brake cylinders?

A.—Until the pressure in the brake cylinders becomes slightly greater than that in the control cylinder, when the application piston will be moved up just far enough to allow the application valve to be seated.

Q.—With the application valve closed, if there be brake cylinder leakage will the locomotive brake leak off?

A.—No; as any drop in brake cylinder pressure will be felt in the chamber below the application piston, causing a difference in pressure on the two sides of the piston, thus allowing the pressure in the control cylinder to move the piston down, again unseating the application valve, allowing a further flow of main reservoir air to the brake cylinders, until the pressure is again slightly greater than that in the control cylinder, when the piston will move up, allowing the application valve to close. Thus in this way air will be supplied to the brake cylinders of the locomotive, holding the brakes applied regardless of leakage.

Q.—What effect will the piston travel have on the pressure developed in the brake cylinders?

A.—None; as the pressure in the brake cylinders is dependent entirely on the pressure in the control cylinder, which is not affected by piston travel.

Q.—Explain the movements of the parts in the control valve, when the automatic brake valve is moved to release position, following an automatic application of the brakes.

A.—In release position air from the main reservoir flows direct to the brake pipe, causing an increase of pressure which is felt in the chamber on the brake pipe side of the triple piston; this increase of pressure will cause the piston to move down, carrying with it the graduating valve and slide valve to release position. This allows air from the control cylinder and reservoir to flow to the control valve release pipe and on to the automatic brake valve, where the port to which this pipe leads is blanked by the automatic rotary valve, which prevents the air from leaving the control cylinder and reservoir, thus holding the locomotive brakes applied while the train brakes are being released.

Q.—Is the action similar where the release is made in holding position?

A.—Yes; only the air for the recharge of the brake pipe comes through the feed valve instead of the large ports in the brake valve.

Q.—Explain the movements of the parts in the control valve when the automatic brake valve is moved to running position, after having first been moved to release or holding position.

A.—In this position of the brake valve, the port to which the control valve release pipe is connected is open to the exhaust through the automatic brake valve, thus allowing the air in the control cylinder and reservoir to escape to the atmosphere, causing a release of the locomotive brake.

Q.—Explain what takes place in the control valve when an automatic emergency application of the brake is made.

A.—Any sudden reduction of brake pipe pressure will be felt on the brake pipe side of the triple piston, and will cause the piston and its slide valve to move to their extreme travel, compressing the graduating spring. In this position auxiliary reservoir air can flow past the end of the slide valve to the control cylinder and reservoir, forcing the application piston and valve to application position, allowing main reservoir air to flow to the brake cylinders, until the pressure in the brake cylinders is slightly greater than that in the control cylinder, when the control piston will be forced upward, allowing the application valve to seat.

Q.—When using a 70-pound brake pipe pressure, what pressure will be developed in the control cylinder and reservoir when an emergency application of the brake is made?

A.—About 50 pounds. However, with the automatic brake valve in emergency

position, there is a small port in the rotary valve (called the blow-down timing port) open to the control reservoir pipe and to the control cylinder and reservoir, admitting main reservoir air to these chambers, building up the pressure, to the adjustment of the safety valve.

Safety Valve

Q.—At what pressure is the safety valve adjusted?

A.—At 68 pounds, except when an engine is being transported over the road light, when it is generally adjusted to 35 pounds.

Q.—How would you proceed to adjust the safety valve?

A.—With the pressure pumped up, move the automatic brake valve to emergency position until a brake cylinder pressure of 68 pounds is developed, then back to lap position; next remove the cap nut on the safety valve and turn the regulating nut up or down as may be required.

Q.—To what is the safety valve connected?

A.—To the control cylinder and reservoir.

Q.—Is the safety valve connected to the control cylinder and reservoir at all times?

A.—Yes; except in service lap posi-

tion, when it is cut off by the graduating valve.

Quick-Action Cap

Q.—What is the purpose of the quick-action cap, and where is it located?

A.—Its purpose is to assist the brake valve in venting the brake pipe air when an emergency application of the brake is made; it is located on the brake pipe side of the control valve.

Q.—Explain the operation of the quick-action cap.

A.—When a sudden brake pipe reduction is made, it will cause the triple piston to move upward its full travel; the knob on the piston striking the graduating stem, causing it to compress the graduating spring, moving the emergency valve, opening the emergency port; this allows brake pipe air to flow against the nonreturn check valve, unseating it, then through a port to the brake cylinders.

Q.—What is the purpose of the nonreturn check valve?

A.—To close the communication between the brake pipe and brake cylinders when the pressure equalizes.

Q.—Explain the movements of the parts when the brake is released.

A.—When the brake pipe is recharged, the triple piston returns to release position, the graduating spring then forces the graduating stem and emergency valve

to their normal position, closing the emergency port.

Q.—Where the quick-action cap is used, is there any difference in the method of operating the brakes?

A.—No; the brakes should be handled in the same manner as with the plain cap.

Dead Engine Feature

Q.—What is the dead engine device, as used with the L-T equipment?

A.—The dead engine device, as used with this equipment, is the same as that used with the E-T equipment; therefore should be operated in a similar manner.

Broken Pipes

Q.—If the pipe leading to the equalizing reservoir breaks, what should be done?

A.—Blank the broken pipe by placing a blind gasket in the connection at the brake valve, plug the brake pipe service exhaust port, and use the valve carefully in emergency position when making service stops.

Q.—If the pipe connecting the feed valve to the automatic brake valve breaks, what may be done?

A.—If this pipe breaks, plug the end toward the brake valve and back off on the regulating nut in the feed valve—this to stop the flow of air. The brake valve

handle will now have to be carried in release position, to admit air to the brake pipe, and as this will allow main reservoir pressure in the brake pipe, the maximum pressure head of the pump governor should be adjusted to the pressure desired in the brake pipe.

Q.—If the brake valve be carried in release position, will there not be a tendency for the locomotive brake to creep on?

A.—Yes; but this trouble may be overcome by disconnecting the release pipe at the control valve.

Q.—If the main reservoir supply pipe to the automatic control valve breaks, what should be done?

A.—As this will cause a loss of main reservoir air, the pipe should be plugged.

Q.—If the supply pipe breaks, can the locomotive brake be applied in a service application? In an emergency application?

A.—The locomotive brake cannot be applied in an automatic service application; but if the control valve be equipped with a quick-action cap and an emergency application is made, the air vented from the brake pipe to the brake cylinders will apply the brake.

Q.—With the engine alone, where the brake pipe volume is small, if the supply pipe breaks, can the brake be applied?

A.—Yes, with the engine alone, the

brake can be applied, providing the control valve is equipped with a quick-action cap. To apply the brake, move the automatic brake valve to emergency position, then return it to holding position, until the brake pipe is recharged to about 40 pounds, when the handle should be moved to lap position. The movement of the brake valve to emergency position causes the triple piston in the control valve to move upward, the knob on the piston striking the graduating stem, causing it to move the emergency valve, opening the emergency port, allowing brake pipe air to flow to the brake cylinders; then by returning the brake valve to holding position, admitting air to the brake pipe, it will be free to flow to the brake cylinders, applying the brake.

Q.—What will be the effect if the control release pipe breaks?

A.—The holding feature of the brake will be lost; that is, the brake will release when the automatic brake valve is returned to release position.

Q.—If the control release pipe breaks, should it be plugged?

A.—No; as when this pipe is plugged, any air leaking into the control cylinder will cause the locomotive brakes to creep on, which is often responsible for loosening of tires, and that which tends to bring about this condition should be avoided.

Q.—If the control release pipe breaks and is plugged, how can the locomotive brake be released after an automatic application?

A.—By holding the special release valve in release position.

Q.—If the brake cylinder pipe breaks, can the locomotive brake be applied with the automatic brake valve?

A.—This depends on where the pipe breaks; if between the cut-out cock and any one of the brake cylinders, close the cut-out cock to that cylinder, and the other cylinders may be used. But if the pipe breaks at the control valve, the automatic brake on the locomotive will be lost.

Q.—If the brake cylinder pipe breaks and is not plugged, as when the brake is inoperative, what must be done?

A.—The cut-out cock in the supply pipe must be closed.

Q.—If the supply pipe cut-out cock is not closed, what will result?

A.—There will be a great loss of main reservoir air through the broken pipe when the train brake is applied.

Q.—If the cut-out cock in the main reservoir supply pipe is not closed, how may this waste of main reservoir air through the broken pipe be overcome?

A.—By holding the special release valve in open position when an automatic

application of the brake is being made on the train.

Q.—If the brake pipe connection to the control valve breaks, what should be done?

A.—Plug the end leading from the brake pipe; the locomotive brake must now be released with the special release valve.

Q.—If the brake pipe connection breaks and is plugged, can the locomotive brake be applied with the automatic brake valve?

A.—The locomotive brake cannot be applied with a service application as now there is no connection between the brake pipe and control valve. However, if the brake valve handle be placed in emergency position, the blow-down timing port will be open to the control cylinder through the control reservoir pipe, thus admitting air to this cylinder, which in turn moves the application piston and valve to application position, allowing main reservoir air to flow to the brake cylinders, applying the brake.

Q.—If the control cylinder pipe breaks, what effect will it have on the locomotive brake?

A.—The brake will not apply; or, if it does, will not remain applied in an automatic application.

Q.—If this pipe breaks and is plugged, can the locomotive brake be applied? If

so, can it be released with the special release valve?

A.—Yes, the locomotive brake can be applied and released with the automatic brake valve in the usual manner. If the break in the pipe is between the control valve and the tee where the pipe branches, one part leading to the special release valve, the other part to the automatic brake valve, or between the tee and special release valve, the use of the special release valve is lost; but if the break is between the tee and the automatic brake valve, the brake may be released in the usual manner with this valve.

Q.—What will be the effect if the continuous feed pipe breaks?

A.—If this pipe breaks, it will cause a loss of air from both the reducing valve pipe and auxiliary reservoir of the control valve; therefore, both ends of the pipe must be plugged.

Q.—If any of the pipes here enumerated break, will it in any way affect an independent application of the brake?

A.—No; as the independent and automatic are entirely separate from each other; that is, the automatic control valve is not brought into use when an independent application of the brake is made. However, if the brake cylinder pipe breaks between the double-throw check valve and the brake cylinders, the independent brake cannot be applied.

Control Valve Defects

Q.—If there is a blow at the control reservoir exhaust port when the brake is released, where would you look for the trouble?

A.—This would indicate a leaky application valve, or where the control valve is equipped with a quick-action cylinder cap, a leak past the emergency valve will also cause a blow at this port.

Q.—How may it be determined which valve is at fault?

A.—Reduce the brake pipe pressure to zero, then release the brake with the special release valve; if the blow continues, the defect will be found in the application valve; if the blow stops, the emergency valve will be at fault.

Q.—If there be a continuous blow at the control valve exhaust port when the brake is applied, where would you look for the trouble?

A.—This would indicate a leaky exhaust valve.

Q.—If the locomotive brake released with the automatic brake valve in lap position, where would you look for the trouble?

A.—Would look for a leak in the control reservoir pipe or special release valve.

Q.—If the brake remained applied in lap position, but released in release or holding position, where would you look for the trouble?

A.—Would look for a leak in the control valve release pipe.

Q.—If, after making a 10-pound reduction of brake pipe pressure, the brake cylinder pressure increased to about 50 pounds, where would you look for the trouble? (This when using a 70-pound brake pipe pressure.)

A.—This would indicate leakage of auxiliary reservoir air past the triple slide valve into the control reservoir.

Q.—If, after making a light application, the brake cylinder pressure increased to the adjustment of the safety valve, where would you look for the trouble?

A.—This trouble may be caused by leakage past the rotary valve, or either of the two lower body gaskets in the automatic brake valve, into the control reservoir pipe.

Q.—If the control reservoir pipe and release pipe were crossed, what would be the effect?

A.—The locomotive brake could not be released with the special release valve.

Q.—If the safety valve leaks, what will be the effect?

A.—This may prevent an automatic application of the brake; but if the brake does apply and the triple piston and graduating valve in the control valve move back to lap position, the brake will remain applied, as now the safety valve is cut off.

Locomotive Brake Creeps On

Q.—If the locomotive brake creeps on with the automatic brake valve in running position, where would you look for the trouble?

A.—This is caused by a variation of brake pipe pressure due either to a non-sensitive feed valve or an overcharged brake pipe, which causes the triple piston and its slide valve in the control valve to move to application position, making an automatic application of the brake.

Q.—If the locomotive brake creeps on, how should it be released?

A.—By moving the automatic brake valve handle to release position and returning it immediately to running position.

Q.—Why not make the release with the special release valve?

A.—Where the brake is released with the special release valve, the triple piston and its slide valve are not moved to release position; therefore, the brake would immediately reapply.